LFUCG CONSTRUCTION INSPECTION MANUAL
DATED JANUARY 1, 2005

AMENDMENT NO. 1 - FINAL

OCTOBER 1, 2018

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AMENDMENT NO. 1

OCTOBER 1, 2018

Amendment No. 1 includes the following changes:

Chapter 3 – Records and Reports
Section 3.2.5 – Manhole Vacuum Test Report

- Text was added to require a minimum vacuum test time of one minute and Figure 3.5 was revised accordingly.

Chapter 7 – Appurtenances
Section 7.3.5 – Manholes

- Text was added to require a minimum vacuum test time of one minute.

Appendix

- The Manhole Vacuum Test Report form was revised to require a minimum vacuum test time of one minute.

CHAPTER 3
RECORDS AND REPORTS

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3.1 Introduction

3.1.1 General

Construction records and reports provide documentation of data, activities, transactions, and verbal communications relating to the project. The importance of good construction records and reports cannot be overemphasized. During execution of the project, records and reports enable other personnel who are not directly involved with its construction to monitor and assess the work as it progresses. Following completion of construction, the records and reports provide permanent documentation of the work as performed. This information may be used for payment purposes, resolution of disputes, and re-creation of the job history.

Reporting of the work should be secondary to the actual observation of the construction process. While it is essential that the Inspector not allow report writing to interfere with the prime objective of his job, records and reports must be considered as an integral part of the inspection process. Records and reports must be accurate and shall be written promptly while job occurrences are still easily recalled by the Inspector.

All records and reports must be completed in a neat and organized manner. The Inspector should remember that his/her reports and records will be viewed by others, and that they may even be presented in a court of law as evidence relative to the project. As a result, erasures of recorded data shall not be permitted in any reports that document job progress. Any errors or mistakes shall be crossed out with single lines so that the original words or numbers are still legible. The use of slang terms should be avoided when writing reports.

3.1.2 Definitions

Admixtures - Materials other than water, aggregate, or cement added to the batch before or during mixing to modify the properties of the concrete mix. Examples include air-entraining admixtures, water reducers, and superplasticizers.

Aggregates - A hard granular material of mineral composition such as sand, gravel, slag, or crushed stone, used for mixing in graduated sizes of fragments.

Air Content - Percent of air by volume in fresh concrete determined by ASTM C 231, ASTM C 173, or ASTM C 138.

ASTM - An abbreviation for American Society for Testing and Materials.

Concrete Cylinders - Concrete samples formed in the field according to ASTM C 31 for laboratory compressive strength testing.

Curing - The maintenance of a satisfactory moisture content and temperature in concrete during a specified period immediately following placement and finishing so that the desired properties may develop.

Exfiltration - The exit of sewage through faulty joints or cracks in pipes or manholes.

Force Main - A pipe under internal pressure created by being on the discharge side of a pumping station.

Infiltration - The entrance of groundwater into a sewer system through faulty joints or cracks in the pipes or manholes.

Maximum Dry Density - The maximum density obtained in a Proctor moisture-density test using a specific compactive effort and method of compaction specified by ASTM D 698 or ASTM D 1557.

Optimum Moisture Content - The moisture content corresponding to the maximum dry density in a Proctor moisture-density test.

Percent Compaction - The ratio, expressed as a percentage, of: 1) dry unit weight of a soil as established in a job site embankment or backfill; to 2) maximum unit weight obtained in a laboratory compaction test.

Proctor Test - A laboratory compacting procedure whereby a soil at a known water content is placed in a specified manner into a mold of given dimensions, subjected to a compactive effort of controlled magnitude, and the resulting unit weight determined. The procedure is repeated for various water contents sufficient to establish a relation between water content and unit weight.

Record Drawings - Engineering plans that have been revised to reflect all changes to the plans that occurred during construction.

Slope - The gradient in feet per feet or expressed as percent.

Station - A distance of 100 feet, measured along a centerline or baseline and designated by a stake bearing its number.

Structural Fill - Selected fill material placed, compacted and inspected according to specific density and moisture requirements.

Surge - The pressure increase observed in a closed conduit system (pipe) during the sudden deceleration of flow due to rapid valve closure or pump shutdown.

Trench - Usually a long, narrow, nearly vertical-sided cut in rock or soil such as is made for utility lines.

Wet Well - Usually an underground circular concrete storage tank for the temporary storage of sewer influent and containment of submersible pumps, piping, and float bulb switches.

3.2 Inspection Reports and Forms

3.2.1 Daily Field Report

The Daily Field Report is used as a permanent record of the job history, and to provide a means for re-creating job progress on a day-to-day basis. Any job-related items that the Inspector feels is relatively important shall be included in the Daily Field Report. An example of a completed Daily Field Report is shown in Figure 3.1.

All Daily Field Reports must be completed daily, preferably as soon as possible after specific events occur. They must not be written in "bunches" every two or three days, or at the end of the week. The Inspector must submit all Daily Field Reports to the Engineer at the end of each day.

Daily Field Reports shall have, as a minimum, the following information:

(1) **Site Specific Information** - The project name, job number, date, Inspector's time of arrival and departure, Contractor's representatives, equipment on site, and visitors on site.

(2) **Weather** - The daily temperature, sky conditions, presence of rain, snow, or wind.

(3) **Daily Work Completed** - Summarize the construction activities of the day. List specific details such as how many cubic yards of concrete were placed, the number of embankment lifts that were compacted, or how many linear feet of pipe were installed. When summarizing activities, describe the construction methodologies used to perform the work. Examples include trench backfilling procedures or procedures used to consolidate concrete. Comment on any testing performed during the day and the results of the tests.

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FIGURE 3.1
Daily Field Report

DAILY FIELD REPORT

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Project GARDEN SPRINGS SANITARY SEWER
Date 8-21-97
Location LINE A - STA. 1+60
Inspector JOHN SMITH
Project/Contract No. 1096
Contractor BROWN CONSTRUCTION
Weather CLOUDY Temperature 80°F
Present at Site MIKE BROWN

THE FOLLOWING WAS NOTED TODAY:

I ARRIVED ON-SITE ON THURSDAY 8/21/97 @ 8:00 A.M. AND OBSERVED BROWN CONSTRUCTION CONDUCT LOW PRESSURE AIR TESTS ON FOUR PIPE SECTIONS OF LINE A FROM STA. 1+00 TO STA. 4+60. ALL PIPE SECTIONS, EXCEPT FOR STA. 3+82 TO STA. 4+60, PASSED THE INITIAL LOW PRESSURE AIR TESTS. A TV SURVEY OF THE FAILED SECTION IDENTIFIED A CRACKED PIPE AT STA. 4+11. THE CONTRACTOR EXCAVATED AND REPAIRED THE DAMAGED PIPE AND PERFORMED A PASSING AIR TEST. THE RESULTS OF THE LOW-PRESSURE AIR TESTS ARE SUMMARIZED ON THE ATTACHED LOW-PRESSURE AIR TEST REPORT.

DEFLECTION TESTING WILL BE PERFORMED ON 8/22 AT 8:00 AM.

I LEFT THE SITE AT 3:30 P.M.

JOHN SMITH

Copies To: LFUCG, ABC ENGINEERING

Signed: John Smith

Attachments: LOW PRESSURE AIR TEST REPORT

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(4) Unusual Occurrences - List any adverse conditions encountered such as soft soil conditions, unexpected bedrock, presence of ground water, utility conflicts, equipment breakdowns, and unsafe conditions. Report any delays, and identify causes for the delays. Discuss any controversial matters, noting any deficiencies or violations by the Contractor with respect to the Contract Documents. Also, describe any corrective measures undertaken by the Contractor.

(5) Instructions Issued and Received - Any instructions pertaining to the project that are issued or received by the Inspector shall be recorded. The recipient or source of the instructions must be identified.

3.2.2 Field Density Report

Field Density Reports are used to summarize the test results from daily in-place moisture and density determinations of engineered structural fill. Nuclear test methods (ASTM D 2922 and ASTM D 3017) are typically used to perform rapid, nondestructive in-place density and moisture determinations. Another method, though not as common, is the sand cone (ASTM D 1556). Field Density Reports are used as a permanent record of the construction of earth embankments and structural fill. An example of a completed Field Density Report is presented as Figure 3.2.

Data on the Field Density Reports shall be recorded as the tests are performed. The Inspector shall submit the Field Density Reports to the Engineer as an attachment to the Daily Field Report. As a minimum, the following information shall be included on all Field Density Reports:

(1) The project name, project number, date, the Inspector's name, and the Contractor.

(2) A location description for each density test. This description shall reference the layer/lift of fill (i.e., second lift, etc.), project stationing, offset, elevation, etc.

(3) Density tests shall be chronologically numbered for the duration of the project.

(4) The measured values of in-place dry density and moisture content.

(5) The maximum dry density and optimum moisture content as determined by the standard Proctor (ASTM D 698) or the modified Proctor (ASTM D 1557) compaction tests.

FIGURE 3.2
Field Density Report

FIELD DENSITY REPORT

Project	PALOMAR HILLS PUMP STATION ACCESS ROAD	Contractor	BROWN CONSTRUCTION
Project/Contact No. 1623	Date 8-21-97	Inspector	JOHN SMITH

Test No.	Test Location	Dry Density (pcf)	Moisture (%)	Proctor Density (pcf)	Optimum Moisture (%)	Compaction (%)	Required Compaction (%)	Pass or Fail
1	COMPACTED SUBGRADE STA. 1+10, 5' RT.	113.4	14.5	116.9	14.7	97	95	PASS
2	COMPACTED SUBGRADE STA. 1+60, ℄	118.1	15.1	116.9	14.7	101	95	PASS
3	COMPACTED SUBGRADE STA. 2+00, 5' LT.	108.7	14.9	116.9	14.7	93	95	FAIL
4	COMPACTED SUBGRADE STA. 2+40, ℄	114.5	16.9	116.9	14.7	98	95	FAIL
5	#3 RETEST	112.2	14.9	116.9	14.7	96	95	PASS
6	#4 RETEST	114.3	15.5	116.9	14.7	98	95	PASS

Remarks: TEST #3 FAILED DUE TO COMPACTION LESS THAN 95%, AREA RECOMPACTED AND RETESTED - #5
TEST #4 FAILED DUE MOISTURE GREATER THAN 16.7%, AREA DISKED, DRIED, AND COMPACTED - #6

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(6) The relative compaction of the measured in-place density reported as a percentage of the Proctor density.

(7) The required relative compaction expressed in terms of percent of Proctor density (i.e., 95 percent of Proctor).

(8) A pass or fail determination based on the allowable moisture content deviations from optimum, and the required relative compaction value specified in the Contract Documents.

All passing and failing field density tests shall be reported. Fill represented by failing tests shall be reworked, recompacted, or replaced until the requirements of the Contract Documents are achieved. Finally, field density tests of reworked fill shall be noted as retests of previously tested areas.

3.2.3 Low-Pressure Air Test Report

Low-pressure air tests shall be performed on flexible and rigid-pipe gravity sanitary sewers in accordance with UNI-B-6-90 and ASTM F1417 for plastic and ductile iron pipe, respectively, and ASTM C924 for concrete pipe. An example of a completed Low-Pressure Air Test Report is shown in Figure 3.3. In the report, the type, size, and location of the pipe tested are identified. The time required for completion of the air test varies with pipe size in accordance with the applicable specification. In addition, the Low-Pressure Air Test Report is used to record the results of deflection tests. Following the completion of either test, the results of the test are noted by writing either "passed" or "failed" on the appropriate line. Since low-pressure air tests and deflection tests of a sewer line are often conducted on separate days, the date of a particular test shall be properly noted. If an air or deflection test should fail, then a passing retest of that pipe section must be performed and documented. The Low-Pressure Air Test Report shall be submitted to the Engineer as an attachment to the Daily Field Report.

3.2.4 Sewer Infiltration / Exfiltration Report

Infiltration and exfiltration tests are used to assess the leakage potential of installed sanitary sewers. These tests shall be conducted in accordance with ASTM C 969.

An example of a completed Infiltration/Exfiltration Test Report is shown in Figure 3.4. In the report, the type of test performed shall be identified by circling either "Exfiltration" or "Infiltration" at the top of the report. Similar to the Hydrostatic Test Report, all information relative to the sewer pipe being tested shall be entered on the lines provided, and the allowable leakage of the sewer during the test shall be determined by filling in the appropriate data and performing the necessary calculations as outlined in the report.

LOW-PRESSURE AIR TEST REPORT

Project GARDEN SPRINGS SANITARY SEWER Date 8-21-97

Location LINE A STA. 1+00 TO STA. 3+82 Inspector JOHN SMITH

Project/Contract No. 2962 Contractor BROWN CONSTRUCTION

Pipe Under Test				Specification Time	Field Test Operations Data						Deflection Test
Upstream MH sta #	Downstream MH sta #	Dia D (in)	Length L (ft)	Refer to UNI-B-6 (min:sec)	Pressure Initially Raised To (psig)	Time Allowed for Pressure to Stabilize (min)	Start Test Pressure (psig)	Stop Test Pressure (psig)	Elapsed Time (min:sec)	Pass or Fail (P or F)	Pass or Fail (P or F)
1+00	2+60	8	160	7:34	4.2	3	4.0	3.6	7:34	P	P
2+60	3+82	8	122	7:34	4.3	2	4.0	3.4	7:34	P	P
3+82	4+60	12	78	11:20	4.1	2	4.0	0.5	0:30	F	P
4+60	8+12	12	352	20:08	4.2	2	4.0	3.1	20:08	P	P
3+82	4+60	12	78	11:20	4.2	2	4.0	3.6	11:20	P	P

If a section fails, the following items should be completed:

Identify section(s) that failed STA. 3+82 TO STA. 4+60 Description of leakage found: CRACKED PIPE @ STA. 4+11

Leak (was) (was not) located. Method used: TV SURVEY Description of corrective action taken: PIPE REPLACED

Remarks: 5% DEFLECTION TESTS WERE PERFORMED WITH A "GO/NO GO" MANDREL AFTER EACH PIPE PASSED AN AIR TEST. ALL DEFLECTION TESTS PASSED.

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INFILTRATION/EXFILTRATION TEST REPORT

Project PALOMAR HILLS SANITARY SEWER
Date 8-21-97
Location PALOMAR BLVD.
Inspector JOHN SMITH
Project/Contract No. 1010
Contractor BROWN CONSTRUCTION

☐ Infiltration Test
☑ Exfiltration Test

(1) TEST INFORMATION:

Pipe Description LINE A STA. 1+00 TO STA 3+58
Pipe Diameter (A) 8" PVC (inches)
Pipe Length (B) 258 (feet)
Length of Test (C) 2 (hours)

(2) ALLOWABLE LEAKAGE:

Total Allowable Leakage (TAL) = 200 gallons per inch diameter, per mile of pipe, per 24 hours.

TAL = 200 x A x (B ÷ 5,280) x (C ÷ 24)

= 200 x 8 x (258 ÷ 5,280) x (2 ÷ 24)
= 6.52 gallons

(3) TEST RESULTS:

The Total Leakage for Test (TLT) for the exfiltration test may be determined by measuring the decrease in the height of the water in the manhole. If this method is utilized, the following formula may be used to calculate the TLT in terms of gallons:

Diameter of Manhole (D) 4 (feet)

Decrease in Manhole Water Level (E) 0.25 (feet)

TLT = E x 3.14 x (D ÷ 2)^2 x 7.48
= 0.11 x 3.14 x (4 ÷ 2)^2 x 7.48
= 10.33 (gallons)

Final Result FAIL

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When computing the allowable leakage, the pipe diameter must be expressed in inches and the pipe length must be expressed in feet.

The results of the test are determined by measuring the total leakage that occurs during the test. During infiltration testing, the flow may be measured by utilizing a flow measuring device such as a flow meter or a V-notch weir, or by directing the inflow into a container of known volume. During exfiltration testing, the total leakage that occurs during the test is generally determined by measuring the decrease in the height of the water in the upstream manhole. If this method is utilized, the total leakage of the test (TLT) may be determined by using the formula included on the report. When using this formula, the decrease in the water level in the manhole and the radius of the manhole must be expressed in feet. It should be noted that this method of measuring the total leakage will not be valid if the level of water in the manhole drops below the crown of the sewer pipe. If this occurs, the total leakage for the test should be determined by measuring the quantity of water required to raise the water level in the manhole to its original position.

3.2.5 Manhole Vacuum Test Report

Vacuum tests shall be performed on all sanitary manholes according to ASTM C1244. An example of a completed Manhole Vacuum Test Report is shown in Figure 3.5. In the report, the depth, diameter, location, and required test time for the manhole are noted.

The minimum test time required for the completion of the vacuum test varies with manhole depth and diameter. Minimum test times are tabulated in ASTM C1244; however, LFUCG requires a minimum vacuum test time of one minute (60 seconds), which is contrary to ASTM C1244 for certain manhole depth and diameter combinations. Information about required testing times is provided on the report form found in Appendix C. Following the completion of a test, the results are noted by writing either "passed" or "failed" on the appropriate line. If a vacuum test should fail, then a passing retest of the manhole must be performed and documented. The Manhole Vacuum Test Report shall be submitted to the Engineer as an attachment to the Daily Field Report.

3.2.6 Pump Station Wet Well Vacuum Test Report

Vacuum tests shall be performed on all pump station wet wells according to the LFUCG test procedures given in Section 8.0. An example of a completed Pump Station Wet Well Vacuum Test Report is shown in Figure 3.6. In the report, the depth, diameter, location, and required test time for the wet well are noted. The minimum test time required for the completion of the vacuum test varies with wet well depth and diameter. Minimum test times required by the LFUCG are tabulated in Section 8.0 and on the report form. Following the completion of a test, the results are noted by writing either "passed" or "failed" on the appropriate line. If a vacuum test should fail, then a passing retest of the wet well must be performed and documented. The Pump Station Wet Well Vacuum Test Report shall be submitted to the Engineer as an attachment to the Daily Field Report.

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FIGURE 3.5
Manhole Vacuum Test Report

MANHOLE VACUUM TEST REPORT

Project Palomar Hills

Date 8-21-97

Location Palomar Blvd at Palmetto Drive

Inspector John Smith

Project/Contract No. 1010

Contractor Brown Construction

(1) **MANHOLE INFORMATION:**

Manhole Station 3+54

Manhole Diameter 4 (feet)

Manhole Depth 10 (feet)

Minimum Test Time 60 (sec) (See Table)

(2) **TEST RESULTS:**

Test Starting Time 8:20:00 Gauge Reading 10.0 (in. Hg)

Test Ending Time 8:21:00 Gauge Reading 9.7 (in. Hg)

Final Result Passed

Minimum Test Times for Various Manhole Diameters (seconds)

~NOTE: If the test time is grayed out in the table below, then the vacuum test time for that particular manhole diameter and depth shall be a minimum of one minute.~

Manhole Depth (ft)	Manhole Diameter (ft) 4.0	4.5	5.0	5.5	6.0
	Time (seconds)				
8	20	23	26	29	33
10	25	29	33	36	41
12	30	35	39	43	49
14	35	41	46	51	57
16	40	46	52	58	67
18	45	52	59	65	73
20	50	53	65	72	81
22	55	64	72	79	89
24	59	64	78	87	97
26	64	75	85	94	105
28	69	81	91	101	113
30	74	87	98	108	121

CONSTRUCTION INSPECTION MANUAL	FIGURE 3.6 Pump Station Wet Well Vacuum Test Report

PUMP STATION WET WELL VACUUM TEST REPORT

Project KINGSTON SEWER IMPROVEMENTS Date 8-21-97

Location KINGSTON RD @ ELMWOOD DR. Inspector JOHN SMITH

Project/Contract No. 1236 Contractor BROWN CONSTRUCTION

(1) WET WELL INFORMATION:

Wet Well Diameter 4 (feet)

Wet Well Depth 18 (feet)

Minimum Test Time 1 (minutes)

(2) TEST RESULTS:

Test Starting Time 8:35 AM Gauge Reading 10.0 (in. Hg)

Test Ending Time 8:36 AM Gauge Reading 9.5 (in. Hg)

Final Result PASSED

Minimum Test Times for Various Wet Well Diameters (minutes)

Wet Well Depth (ft)	Wet Well Diameter (feet) 4.0	5.0	6.0	8.0
	Time (minutes)			
<20	1	2	3	4
>20	2	3	4	5

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3.2.7 Pump Station Equipment Check List

The Pump Station Equipment Check List shall be completed after the pump station is constructed and prior to the initial start-up of the station. An example of a completed Pump Station Equipment Check List is shown in Figure 3.7. The Inspector shall carefully check the pump station to verify that pertinent items included on the form have been installed and are working. Any deviation from the Contract Documents shall be listed under remarks. Following completion of the check list, the form shall be submitted to the Engineer as an attachment to the Daily Field Report.

3.2.8 Pump Station Start-Up Report

Prior to final acceptance of a pump station by LFUCG, a Pump Station Start-Up Report must be completed. The purpose of the Pump Station Start-Up Report is to verify that all components of the pump station are working properly. An example of a Pump Station Start-Up Report is shown in Figure 3.8. All information on the report must be completed by the Inspector, and the form shall be forwarded to the Engineer. Any components that are found to not function properly shall be repaired or replaced as soon as possible, and a new Pump Station Start-Up Report shall be submitted.

3.2.9 Force Main Hydrostatic Test Report

Hydrostatic testing is required on all force mains. An example of a completed Force Main Hydrostatic Test Report is shown in Figure 3.9. In the report, all pertinent information relative to the force main shall be entered on the lines provided. The allowable leakage of the force main may be easily determined by filling in the appropriate data and performing the necessary calculations as outlined in the report. When computing the allowable leakage, the pipe diameter must be expressed in inches and the pipe length must be expressed in feet. In addition, the testing pressure and the testing period are to be recorded. The force mains should be filled with water and subjected to an internal pressure of 100 psi or twice the surge plus operating pressure, whichever is greater, but not to exceed 125 percent of the maximum pressure rating for the pipe, measured at the downstream end. The testing pressure should be held for a period of 2 hours. Evaluation of the final results is to be noted by writing "passed" or "failed" on the appropriate line. The Force Main Hydrostatic Test Report shall be submitted to the Engineer as an attachment to the Daily Field Report.

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FIGURE 3.7
Pump Station Equipment Check List

PUMP STATION EQUIPMENT CHECK LIST

Page 1 of 2

Project WYNDHAM HILLS PUMP STATION   Date 8-21-97
Location WEBER WAY   Inspector JOHN SMITH
Project/Contract No. 2168   Contractor BROWN CONSTRUCTION

☑ Review Specifications   ☑ Copies of O & M Manual

Access Road: ☑ Paved   ☐ Stone

Landscape: ☐ Stone   ☐ Sod   ☑ Seed

Valve Pit

Vent: ☑ Paint   ☑ Hatch Hole Open Arm & Spring   ☑ Clean
☑ Drain Check Value   ☑ Air Relief Valve   ☑ 3 Gauge Taps
Gauge: ☑ Ft. of H_2O (head)   ☑ Pressure
☑ Check Value (spring)   ☑ Gate Valve Rising Stem (handwheel)

Pump Station

Vent: ☑ Paint   ☑ Hatch Hole Open Arm & Spring   ☑ Leafs
☑ Pump Cable Holder S.S.   ☑ Tilt Bulb Holder S.S.
☑ Pump Lifting Cable S.S.   ☑ Pump Rails S.S.
☑ Pipe   ☑ Bolts S.S.   ☑ Rail Supports S.S.   ☑ Anchor Bolts S.S.

Electric

Service Pole: ☑ Main Disconnect   ☐ Single Phase   ☑ Three Phase
☑ Light   ☑ Telemetry Panel
☑ Rigid Conduit

Control Cabinet

☑ Stand S.S.   ☑ Cabinet S.S.   ☑ Vault Door Closure Handle
☑ Telemetering S.S.   ☐ Transformer Outdoor Use

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PUMP STATION EQUIPMENT CHECK LIST (continued)

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Check

- [x] Plumb Alignment of Guide Rails
- [x] Easy Pump Removal Through Access Hatch

Tilt Bulb Elevations:
- [x] Pump Off
- [x] No. 1 Pump On
- [x] No. 2 Pump On
- [x] High Wet Well Level

- [x] Tilt Bulb Cable Holder Location for Operational Clearance

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- [x] Power Cable Loop Length (2 ft min)
- [x] Rigid Conduit
- [x] Seal Cable into Cabinet
- [x] Review Plan and Control Cabinet Instruments for Compliance

Remarks READY TO SCHEDULE START UP AFTER CONTRACTOR AND PUMP REPRESENTATIVE ARE ON SITE FOR INSPECTION.

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FIGURE 3.8
Pump Station Start-Up Report

PUMP STATION START-UP REPORT

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Project WYNDHAM HILLS PUMP STATION Date 8-21-97
Location WEBER WAY Inspector JOHN SMITH
Project/Contract No. 2168 Contractor BROWN CONSTRUCTION

Pump Specifications:
Manufacturer GOULDS Model No. 44371 H.P. 5
Phase SINGLE Cycle ____ Volts 230 Amps 14.8 / 7.4 GPM 200

Number 1 Pump Serial Number 5HUK1267-3-P
Design Total Head 32.5 Operating Head 18.432

Number 2 Pump Serial Number 5HUK1267-4-P
Design Total Head 32.5 Operating Head 18 432

Design Total Head Both Pumps 32.5 Operating Head 23.04

Telephone Service Number 555-1234 Electric Meter Number 364368
Incoming Voltage P-1 244 P-2 240 P-3 240

Manual Operating Pump Number 1: Running Light On OK
Amps: P-1 12.6 P-2 14.4 P-3 12.4 Volts: P-1 244 P-2 240 P-3 239
Gauge Reading PSI 8 x 2.304 = 18.432 Ft. of H_2O Head
Piping Leaks No Check Valve Operation OK

Manual Operating Pump Number 2: Running Light On OK
Amps: P-1 13.0 P-2 13.3 P-3 11.2 Volts: P-1 244 P-2 240 P-3 238
Gauge Reading PSI 8 x 2.304 = 18.432 Ft. of H_2O Head
Piping Leaks No Check Valve Operation OK

Manual Operation Both Pumps:
Pump Number 1
Amps: P-1 12.3 P-2 12.5 P-3 10.3 Volts: P-1 242 P-2 240 P-3 237
Pump Number 2
Amps: P-1 12.9 P-2 13.5 P-3 10.4 Volts: P-1 242 P-2 240 P-3 237
Discharge Gauge Reading: PSI 10 x 2,304 = 23.04 Ft. of H2O Head

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PUMP STATION START-UP REPORT (continued)

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Automatic Operation:

Lead Selector Pump No. 1

Pump On OK Pump Off OK

Lead Selector Pump No. 2

Pump On OK Pump Off OK

Remarks: THE PUMP STATION PASSED ALL TESTS AND WAS ACCEPTED.

Inspector JOHN SMITH

Contractor BROWN CONSTRUCTION

Factory Service Representative BOB JONES

CONSTRUCTION INSPECTION MANUAL	FIGURE 3.9 Force Main Hydrostatic Test Report

FORCE MAIN HYDROSTATIC TEST REPORT

Project KINGSTON SEWER IMPROVEMENTS Date 8-21-97

Location KINGSTON RD @ ELMWOOD DR. Inspector JOHN SMITH

Project/Contract No. 1236 Contractor BROWN CONSTRUCTION

(1) TEST INFORMATION:

Pipe Description/Location FORCE MAIN A STA. 1+00 TO 54+00

Pipe Diameter (A) 6" D.I. (inches)

Pipe Length (B) 5300 (feet)

Length of Test (C) 24 (hours)

Testing Pressure 100 (psi)

Note: Testing pressure equals 100 psi or twice the surge plus operation pressure, whichever is greater, but not to exceed 125 percent of the maximum pressure rating for the pipe, measured at the downstream end.

(2) ALLOWABLE LEAKAGE:

Total Allowable Leakage (TAL) =0.5 gallons per inch diameter, per 1,000 feet, per hour.

TAL = 0.5 x A x (B ÷ 1,000) x C = 0.5 x 6 x 5300 ÷ 1,000 x 24

= 381.60 gallons

(3) TEST RESULTS:

Test Starting Time 8:10AM 8/21 Meter Reading (D) 1012.5 (gallons)

Test Ending Time 8:10AM 8/22 Meter Reading (E) 1371.9 (gallons)

Total Leakage for Test (TLT) = E - D = 1371.9 - 1012.5 = 359.4 gallons

Final Result PASS

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3.2.10 Pavement Subgrade Inspection Report

Prior to placement of granular base, the subgrade shall be inspected to ensure that it meets the requirements of the Contract Documents and to verify that site conditions are consistent with the Plans. The Pavement Subgrade Inspection Report form is to be used by the Inspector to record his/her field observations. An example of a completed form is shown in Figure 3.10. The Inspector shall submit the Pavement Subgrade Inspection Report Form to the Engineer as an attachment to the Daily Field Report.

3.2.11 Pre-Concreting Inspection Report

Pre-concreting Inspection Reports are used to record observations made during the inspection of the steel reinforcement installation, form work, and excavations for concrete structures prior to concrete placement. An example of a completed Pre-concreting Inspection Report is shown in Figure 3.11. The report serves as a basic checklist of items to which the Inspector should be alerted and shall be completed as the elements are being inspected. The Inspector shall submit the Pre-concreting Inspection Report to the Engineer as an attachment to the Daily Field Report.

3.2.12 Report of Test on Concrete Cylinders

Acceptance testing of fresh concrete generally involves the molding (ASTM C 31) and testing (ASTM C 39) of concrete cylinders. The Report of Tests on Concrete Cylinders is used to record field observations and test results. Report originals shall accompany the cylinders to the laboratory for the recording of compression test results. Field copies shall be submitted to the Engineer as attachments to the Daily Field Report. An example of a completed Report of Tests on Concrete Cylinders is shown in Figure 3.12.

Concrete inspection includes measuring and recording the slump (ASTM C 143), air content (ASTM C 173 or ASTM C 231), and temperature of fresh concrete. All concrete testing shall be performed after the addition of any water or admixtures. If water or admixtures are added after the initial concrete tests, a second set of tests shall be performed after a minimum of 30 additional mixing revolutions. The procedures for field sampling and testing of fresh concrete are included in Section 11.0.

When inspecting fresh concrete, the Inspector shall receive a batch delivery ticket immediately when the delivery arrives. The ticket shall be inspected to determine when the mix was batched, the volume delivered, the concrete type, and the design strength. This information, along with any additions to the mix after delivery, such as water or admixtures, shall be noted in the report form. The Inspector shall also record the elapsed time and number of drum revolutions between the introduction of water to the cement and aggregate at the plant and the discharge of the fresh concrete at the site.

PAVEMENT SUBGRADE INSPECTION REPORT FORM

Page 1 of 2

Project SOUTH POINT SUBDIVISION Date 8-25-97

Street Name WHITFIELD DRIVE Inspector JOHN SMITH

Station 1+00 to 5+00 Contractor BROWN CONSTRUCTION

Project/Contract No. 2697

Weather SUNNY Temperature 88°F

General:

	YES	NO	N/A	Remarks
Bedrock Undercut Performed	☐	☐	☒	NONE REQUIRED
Utilities Installed	☒	☐	☐	SAN. SEWER, STORM SEWER, GAS
Ruts	☐	☒	☐	
Alignment/Grade Correct	☒	☐	☐	
Large Stones	☐	☒	☐	
Excessive Dust	☐	☒	☐	
Wet	☐	☒	☐	
Field Density Tests	☒	☐	☐	SEE FDT #'s WF-101 THRU WF-109

Subgrade Stabilization:

Stabilization Method:

- ☒ Not Required
- ☐ Material Removal and Replacement
- ☐ Crushed Stone
- ☐ Geosynthetics
- ☐ Chemical (Lime or Cement)

Remarks ______________________

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PAVEMENT SUBGRADE INSPECTION REPORT FORM (continued)

Page 2 of 2

Proof Roll:

Truck Model FORD – TRIAXLE

Gross Weight 37 TONS

☒Pass ☐Fail

Remarks

CONSTRUCTION INSPECTION MANUAL

FIGURE 3.11
Pre-Concreting Inspection Report

PRE-CONCRETING INSPECTION REPORT

Project: PALOMAR HILLS
Date: 8-21-97
Location: PALOMAR BLVD.
Inspector: JOHN SMITH
Project/Contract No.: 1010
Contractor: BROWN CONSTRUCTION

Structure/Element: DETENTION POND #1 OUTLET STRUCTURE

Plans Used

☑ Contract Drawings ☐ Shop Drawings Drawing No.(s) ________

Do the following items comply with **Plans and Contract Documents?**

REINFORCING STEEL

	YES	NO
Rebar Size	☑	☐
Spacing	☑	☐
Supports	☑	☐
Straight	☑	☐
Clean	☑	☐
Tied	☑	☐
Clearances	☑	☐
Dowels	☑	☐
Damaged Epoxy Repaired	☐	☐

FORMS

	YES	NO
Size/Alignment	☑	☐
Clean	☑	☐
Wet or Oiled	☑	☐
Tightness	☑	☐

EXCAVATION

	YES	NO
Level	☑	☐
Loose Soil Remove	☑	☐
Free of Water	☑	☐

REMARKS ALL REINFORCING STEEL GRADE 60.

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REPORT OF TEST ON CONCRETE CYLINDERS

Project SOUTHPOINT RD. RETAINING WALL Date 8-2-97
Location SOUTHPOINT RD. @ MARWOOD DR. Inspector JOHN SMITH
Project/Contract No. 1098 Contractor BROWN CONSTRUCTION

(1) FIELD DATA:

Location of Concrete EAST FOOTING

Cylinder/Set No. 3 Slump 4.5 (inches) Air Content 5.2 (%)

Concrete Temperature 80 (°F) Ambient Temperature 85 (°F)

Specified Strength & Type 3500 PSI Date Sampled 8-2-97

(2) LABORATORY RESULTS:

Cylinder Number	3A	3B	3C	3D		
Date Received	8-4	8-4	8-4	8-4		
Date Tested	8-9	8-30	8-30			
Age When Tested (days)	7	28	28	SPARE		
Maximum Load (pounds)	104600	118700	119300			
Compressive Strength (psi)	3700	4200	4220			

(3) REMARKS:

SUPPLIER: BLUEGRASS CONCRETE, TRUCK # 120, TICKET # 021398
8 YD^3 PLACED IN EAST FOOTING.

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After molding, all concrete cylinders shall be capped to prevent the loss of moisture and allowed to cure for 24 hours before moving. Appropriate methods shall be taken to protect the cylinders from motion, evaporation, or freezing according to ASTM C 192. After 24 hours, the cylinders shall be carefully transported to a laboratory for final curing and future testing.

3.2.13 Contractor Submittal Log

The Contractor Submittal Log shown in Figure 3.13 is used to provide a permanent record of all submittals by the Contractor. These submittals typically include shop drawings, material samples, and other required or requested data received during construction. The log shall list a description of each submittal received, along with the date, the specification reference, the number of copies received, any necessary actions, and the date returned.

Maintenance and coordination of this document are typically the responsibility of the Engineer. However, it is the Inspector's responsibility to ensure that he/she possesses the current edition of the log throughout construction. The submittal log will enable the Inspector to track submittals and verify that the appropriate reviews of materials and plans have been made before incorporation into the work.

3.2.14 Erosion and Sediment Control Inspection and Maintenance Report

The Erosion and Sediment Control Inspection and Maintenance Report form shown in Figure 3.14 is a permanent record of the inspection and maintenance of erosion and sediment control facilities. The facilities shall be inspected weekly and after every significant rainfall. The report shall list a description of each area inspected, the type of erosion control facility inspected, the required maintenance, and the date of repairs.

FIGURE 3.13
Contractor Submittal Log

CONTRACTOR SUBMITTAL LOG

Project WYNDMAN HILLS PUMP STATION

Submittal Log Issue Date 8-1-97

Project/Contract No. 2168

Contractor BROWN CONSTRUCTION

Date Rec'd	Trans. mittal No.	Description	Ref. Spec. Section	Con tractor Trans. No.	No. Copies Rec'd	Action: No Exceptions Taken	Action: Made Noted Corrections	Action: Revise & Resubmit	Action: Rejected	Date Returned	Copies No Copies Ret'd	Remarks
8/3/97	1	VALVES	3.7.1. P. 100	1	7		X	X		8/10/97	1	SEE LATER SUBMITTAL
8/3/97	1	CONTROL CABINET	8.3.4. P. 153	1	7	X				8/10/97	1	OK TO USE
8/14/97	2	CONCRETE MIX	5.3.1. P. 140	2	7			X		8/20/97	1	SEE LATER SUBMITTAL
8/14/97	2	SAND	4.2.1. P.135	2	7	X				8/20/97	1	OK TO USE
8/14/97	2	GRAVEL	4.2.1 P.136	2	7	X				8/20/97	1	OK TO USE

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EROSION AND SEDIMENT CONTROL
INSPECTION AND MAINTENANCE REPORT FORM

(to be completed every 7 days and within 24 hours
of a rainfall event of 0.5 inches or more)

Project PALOMAR HILLS SANITARY SEWER
Date 8-21-97
Project/Contract No. 1623
Contractor BROWN CONSTRUCTION
Location PALOMAR BLVD.
Inspector JOHN SMITH
Days since last rainfall 4
Amount of last rainfall 0.6 inches

STABILIZATION MEASURE SUMMARY

Area	Stabilization Type	Stabilization Installed Correctly?	Date of Stabilization	Condition of Stabilization	Maintenance Needed?	Date of Repairs	Date of Final Stabilization	Remarks
ENTRANCE	CONSTRUCTION	YES	8-1-97	FAIR	YES	—	N/A	ADD GRAVEL
	ENTRANCE							
STA. 1+00 TO	MULCHING &	YES	8-10-97	GOOD	NO	—	8-10-97	
4+00	PERM. SEED							
STA. 4+00 TO	SILT FENCE	YES	8-10-97	FAIR	YES	—	N/A	REMOVE SILT
7+50								STA. 5+00 TO
								5+50

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3.3 Construction Photographs

The importance of routinely taking and logging construction photographs cannot be over emphasized. These photographs are important for documenting construction activities, site conditions, and weather conditions. The Inspector shall make a habit of photographing <u>all</u> aspects of construction and not just those activities that may present potential conflict. The Inspector shall prepare a description log of each photograph when the photograph is taken.

The Inspector shall not wait until the film is developed or the end of the job to prepare logs, as memories can fade. The log shall specifically identify the subject of the photograph and its location, (i.e., station, offset, and elevation). Photographs and logs shall be submitted to the Engineer as soon as practicable after each roll is developed. Finally, construction photographs shall be taken with a camera having an automatic date-recording function.

3.4 Record Drawings

The Record Drawings represent the final record of the as-constructed alignment, layout, and details of the facility. These drawings will be relied upon by LFUCG for future expansion and maintenance planning. The Record Drawings are a dynamic set of plans that are continually updated by the Engineer during construction to reflect minor design changes, deviations from the original plans, and the locations of previously unknown utilities and site conditions.

Considering the Inspector's knowledge of the site and construction activities, it is imperative that he/she routinely review the Record Drawings during construction and at the completion of the project. The Inspector's independent review will reduce errors and omissions present in the final documents.

3.5 References

3.5.1 Publications

ACI Manual of Concrete Inspection, American Concrete Institute, Publication SP-2(92).

Construction Inspection Guidance Manual, Louisville and Jefferson County Metropolitan Sewer District (MSD), Revised Edition, May 1993.

Guide to Earthwork Construction, Transportation Research Board, National Research Council, State of the Art Report 8, 1990.

Lexington/Fayette Urban County Government Sanitary Sewer Pumping Stations General Requirements for Administration, Design, and Construction, July 1992.

National Engineering Handbook Section 19, Construction Inspection, United States Department of Agriculture, Soil Conservation Service, 1985.

3.5.2 Test Methods and Specifications

ASTM C 31, *Standard Practice for Making and Curing Concrete Test Specimens in the Field*

ASTM C 39, *Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens*

ASTM C 94, *Standard Specification for Ready-Mixed Concrete*

ASTM C 143, *Standard Test Method for Slump of Hydraulic Cement Concrete*

ASTM C 172, *Standard Practice for Sampling Freshly Mixed Concrete*

ASTM C 173, *Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method*

ASTM C 231, *Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method*

ASTM C 924, *Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method*

ASTM C 969, *Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines*

ASTM C 1244, *Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test*.

ASTM D 698, *Test Method for Laboratory Compaction Characteristics of Soil Using Standard Method (12,400 ft-lbf/ft^3 (600 kN-m/m^3))*

ASTM D 1556, *Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method*

ASTM D 1557, "*Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))*

ASTM D 2922, *Standard Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)*

ASTM D 3017, *Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)*

UNI-B-90 *Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe*, Uni-Bell PVC Pipe Association

ASTM F1417, *Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines using Low-Pressure Air*

CHAPTER 7
APPURTENANCES

TABLE OF CONTENTS

7.1 Introduction

7.1.1 General

Appurtenances are auxiliary structures or devices that are added to sewers to enhance their operation and to facilitate inspection and maintenance. Appurtenances are integral parts of the sewer system, and must be constructed properly for the sewer system to function as it is designed.

Most appurtenances for public infrastructure are constructed in accordance with the *LFUCG Standard Drawings*. Accordingly, the construction of many types of appurtenances is very similar from one project to another. Some projects, however, may require special designs or construction techniques for appurtenances to function properly in association with the sewer system.

In this section, common types of appurtenances installed for infrastructure will be identified and their related construction procedures will be discussed.

7.1.2 Definitions

Appurtenances - Auxiliary structures such as manholes, catch basins, and service connections attached to the main sewer structure, but not considered as integral parts thereof, for the purpose of enabling the sewer system to function.

ASTM - An abbreviation for American Society for Testing and Materials.

Backfill - The refilling of an excavation after a structure has been placed therein or the material placed in an excavation in the process of backfilling. In sewer construction, backfill refers to the material placed in the trench from the top of the pipe encasement or cap up to the ground or subgrade level.

Branch Sewer - A sewer that receives sewage from collector sewers and discharges into a trunk sewer.

Castings - Metallic objects (normally cast iron) formed of molten metal in a mold. Examples are: manhole lids, manhole rims, catch basin grates, and frames, etc.

Cleanout - An upturned sewer pipe, generally placed at the end of the sewer, for providing means for inserting cleaning tools, for flushing, or for inserting an inspection light into the sewer.

Collector Sewer - A sewer located below a street, alley, or easement that receives flows directly from property service connections, sometimes referred to as the street sewer or sewer main.

Cradle - Refers to bedding and haunching materials (crushed stone or concrete) being laid upward from the trench bottom to the springline of the pipe.

Culvert - Pipe that drains open channels, swales, or ditches under a roadway or embankment.

Donut - A precast concrete ring placed at the top of a manhole to permit minor adjustments in elevation of the manhole frame and cover.

Drop Inlet - An assembly of pipe fittings at a manhole that is utilized when the incoming sewer is considerably higher in elevation than the ongoing sewer.

Encasement - Concrete or crushed stone used to enclose a sewer in a trench. Encasement shall extend all the way around the outside of the exterior wall of the pipe being encased as shown in the *LFUCG Standard Drawings.*

Grout - A fluid mixture of cement, sand, and water that can be poured or pumped easily.

Headwall - A wall at the end of a culvert or drain to protect the fill from scour or undermining, increase hydraulic efficiency, divert direction of flow, and serve as a retaining wall.

Inlet - A form of connection between surface of the ground and a drain or sewer for the admission of surface or stormwater into the sewer system.

Invert - The lower portion of a sewer or structure; the portion that is below the springline and is concave upward. Also, the lowest point on the inside surface of a sewer is referred to as the invert, particularly in reference to the elevation or slope of the sewer.

Junction Chamber - A monolithic concrete structure used to direct the flow from one or more branch sewers into the main sewer.

Lateral Risers - Vertical section of a property service connection specified when the depth of the sewer is excessive. Risers are encased in Class B concrete.

Main Sewer - The principal sewer to which branch sewers are tributary, also called a trunk sewer.

Manhole - A sewer appurtenance installed to provide: 1) access to sewers for inspection and maintenance, and 2) changes in sewer direction, elevation, and grade.

Precast - That which is formed in a mold or formed and distributed by the manufacturer as a complete unit.

Sanitary Sewer - A sewer that carries liquid and waterborne wastes from residences, commercial buildings, industrial plants, and institutions, together with minor quantities of ground, storm, and surface waters that are not admitted intentionally.

Service Laterals - A sanitary sewer line connection from the collection sewer to each adjacent property.

Sewage - Largely, the water supply of the common community after it has been fouled by various uses.

Sewer - A pipe or enclosed channel that carries wastewater or drainage water.

Storm Sewer - A sewer that carries stormwater and surface water, street wash, and other wash waters, or drainage, but excludes domestic wastewater and industrial wastes. Also called a storm drain.

Stormwater - Runoff from a storm event.

Stub - A short section of sewer installed into a manhole and plugged, to provide a future point of entry into the sewer system.

Subgrade - Soil exposed in a trench bottom or a road bed and upon which the pipe bedding material or pavement base material will be placed.

T (TEE) Branch - A pipe joined at a 90 degree angle with another pipe, molded together and manufactured as a whole unit.

Trench - Usually, a long, narrow, near vertical sided cut in rock or soil such as is made for utility lines.

Water Table - A surface of groundwater where the water pressure is equal to the atmospheric pressure. The static water level in a well defines the depth to the water table at that location.

7.2 Types of Appurtenances

Appurtenances that are commonly installed include branches and fittings, stubs, property service laterals, manholes, drop manholes, non-circular manholes, storm sewer inlets, and headwalls. In addition, other structures or devices of special design may be classified as appurtenances. The following paragraphs present brief descriptions of the types of appurtenances commonly utilized.

7.2.1 Branches and Fittings

Branches and fittings typically serve to connect property service laterals to collector sewers and to provide accesses for cleaning and inspection. The most common types of branches are tee and wye branches. Fittings commonly used include bends, spacers, reducers, and caps.

Wyes or tees are used to construct sanitary sewer lateral cleanouts along property service laterals. A cleanout is a vertical pipe with a capped end at the ground surface that provides an entrance for inserting cleaning tools or flushing the sewer lateral.

7.2.2 Stubs

A stub is a short section of sewer pipe installed into a manhole and directed toward an area for which LFUCG anticipates providing future service. The stub shall be a minimum of 12 inches in length and no longer than 6 feet. Following its construction, the upstream end of the stub is sealed with a watertight stopper or bulkhead.

7.2.3 Property Service Laterals and Risers

Lateral connections are often equipped with fittings and steep pipe sections or risers to aid in connecting property service laterals to the main sewer line when the main sewer is excessively deep or below the top of rock elevation. Riser sections provide steep grades within the right-of-way to prevent excessive excavation on private property. Lateral connections and allowable riser slopes are shown in the *LFUCG Standard Drawings*.

7.2.4 Manholes

The manhole is an appurtenance that permits the entry of personnel and equipment for inspection and maintenance of the sewer line. Generally, manholes are placed at all changes in vertical grade or horizontal alignment of the sewer. Sanitary and storm manhole details are illustrated in the *LFUCG Standard Drawings*.

Most manholes utilize precast concrete sections conforming to ASTM C 478. These precast sections typically include base sections, vertical risers, eccentric cones, concentric cones, bottom and top slabs, and grade rings. Figure 7.1 illustrates typical precast concrete manhole assemblies used for sewer construction.

The invert of the manhole is constructed with a channel of equal flow capacity to that of the incoming sewer, and with a bench, referred to as the wash section, which provides a work surface for maintenance.

Manholes are restricted to a minimum inside diameter of 4 feet. The top slab of the manhole is usually constructed of precast concrete eight inches thick, and provided with precast concrete grade rings (donuts) which permit close adjustments of the top elevation. In some manholes, eccentric or concentric cones are used above the top riser section in order to reduce the inside diameter of the manhole. The top is also equipped with a cast iron manhole frame and cover. In high water areas, the castings must be watertight. Manhole steps are made of cast iron or steel with a plastic coating and are embedded in the riser wall during the manufacturer's precasting process. Pipe openings 8 inches and smaller in diameter are generally fitted with watertight sewer pipe connections (elastomeric gaskets or couplings) which provide flexible joint connections between the pipes and the manhole.

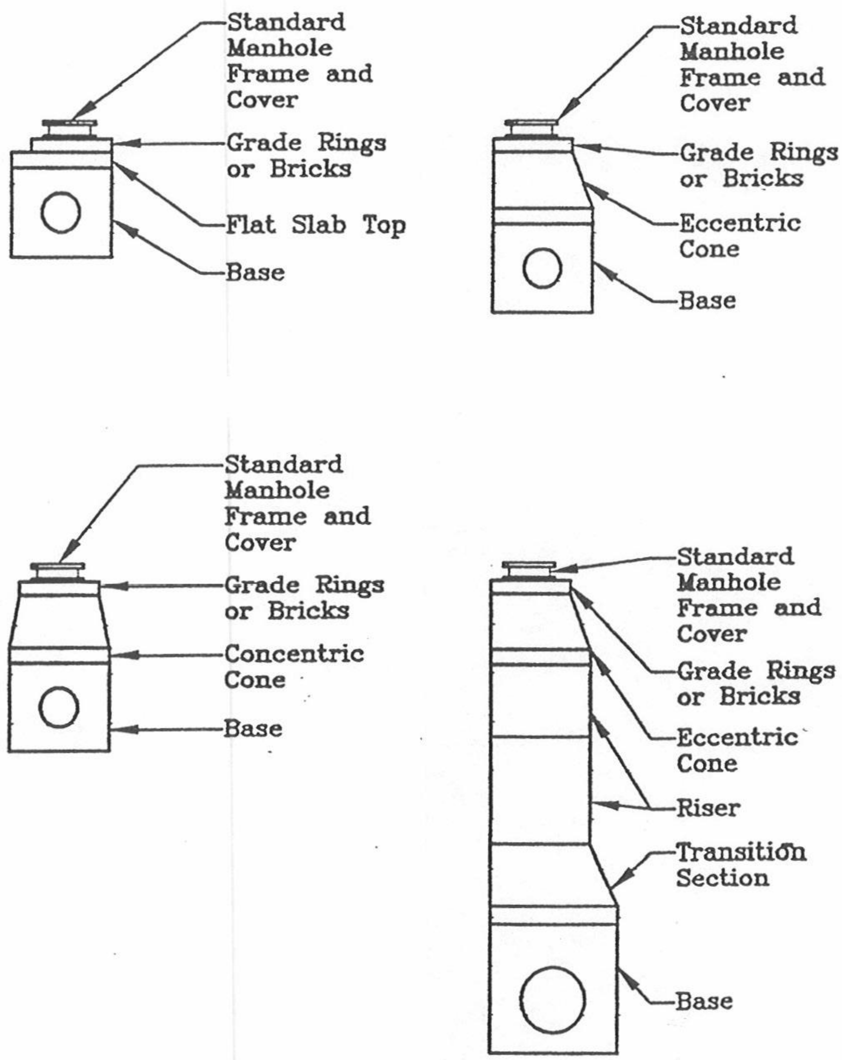
7.2.5 Drop Manholes

If a sanitary sewer enters a manhole at an elevation 2 feet or higher than the outgoing pipe, it is not satisfactory to permit the sewage stream to pour freely into the manhole because the structure would not provide an acceptable working space. Drop manholes are usually provided in these cases. Drop manholes are equipped with an exterior drop inlet encased in concrete that connects the higher invert to the manhole bottom. A typical drop manhole is shown in the *LFUCG Standard Drawings*.

7.2.6 Non-Circular Manholes

Non-Circular Manholes are square or rectangular junction structures installed at the intersections of two or more large sewers. Generally, junction chambers are constructed of precast or cast-in-place concrete, and precast manhole barrels are provided above the structure for inspection and maintenance access as shown in the *LFUCG Standard Drawings*.

	CONSTRUCTION INSPECTION MANUAL	FIGURE 7.1 Precast Concrete Manhole Assemblies



Adapted From: American Concrete Pipe Association

7.2.7 Surface Inlets and Curb Inlets

Storm sewer inlets are generally located at street intersections or at intermediate points along curbs for the purpose of intercepting gutter flows and conveying them into the storm sewer system. Storm sewer inlets are generally constructed of precast or cast-in-place concrete. Inlet castings include frames, grates, and curb irons. Typical surface and curb storm inlets are illustrated in the *LFUCG Standard Drawings*.

7.2.8 Headwalls

Headwalls are reinforced concrete structures normally constructed at both ends of a culvert. These structures provide stability for the pipe, prevent erosion around the ends of the pipe, and promote hydraulic efficiency of the pipe. Depending on the skews, locations and facility types, these structures are designed to accommodate single and multiple lines of circular and non-circular pipes. Typical headwalls are illustrated in the *LFUCG Standard Drawings*.

7.3 Inspection of Appurtenances

7.3.1 General

Careful inspection of the construction of appurtenances is necessary to ensure that the sewer facility functions properly. Like all structures, appurtenances must be accurately located according to Plans and must be constructed properly with respect to required sizes and dimensions.

The foundations for all appurtenances that require concrete construction, such as lateral risers, manholes, drop manholes, storm sewer inlets, non-circular junction structures and headwalls, must be prepared properly. If the appurtenance is to be constructed upon soil, the concrete may be placed, provided that the soil subgrade is judged to be adequate for support of the structure. The excavation shall be kept free of water during construction. Any soil beneath the appurtenance that does not appear to be adequate for support of the structure shall be stabilized as directed by the Engineer. If the appurtenance is to be constructed on or below the bedrock surface, additional rock must be removed and backfilled with crushed stone in accordance with the *LFUCG Standard Drawings*. The crushed stone is provided between the concrete and bedrock to prevent concentrated stresses caused by irregular rock surfaces. Under no circumstances shall the concrete be placed directly against bedrock.

Any branches, fittings, stubs, or sewer pipes that are to remain unconnected following the completion of the project shall be properly sealed. When the open ends of the pipes or fittings are smaller than 18 inches in diameter, the opening shall be sealed with stoppers cemented into place using a rubber gasket between the stopper and bell or socket. Openings 18 inches in diameter or larger shall be sealed with brick masonry or concrete bulkheads at least 4 inches thick.

For precast structures, the following criteria must be met:

1. Any use of precast structures must be so noted in the Contract Documents.

2. Structures that require specially designed footings shall not be precast.

3. Openings in precast structures for pipes shall be the outside diameter of the pipe plus a maximum of 6 inches. In order to use non-shrink grout, the opening shall be the outside diameter of pipe plus 3 inches. (Outside diameter of pipe plus 4½ inches is permissible when tapered hole forms are utilized.)

4. For precast structures (other than those with knockout panels) the opening around the pipe shall either be filled with non-shrink grout for the wall thickness of the structure or the pipe shall be encased with a minimum 6-inch collar of concrete from the inside face of the wall to 1 foot outside the outer face of the wall. The pipe shall be adequately supported to prevent settling while the grout or the concrete encasement is setting up. The inside face of the structure walls shall be finished with a trowel and wet brush finish.

5. For circular structures, the maximum inside diameter (or horizontal dimension) of pipe to be used with a given size of manhole shall meet the requirements shown in the *LFUCG Standard Drawings*.

6. For circular structures, the minimum distance allowed between precast holes for the pipes shall be 12 inches.

7. For circular structures and rectangular structures (other than those with knockout panels), the minimum vertical distance from the holes for the pipes to the top of the structure wall shall be 4 inches. If this vertical distance is less than 12 inches, then additional reinforcing steel shall be furnished for this section. The top slab must be designated for HS-20 loading.

8. For precast structures with knockout panels, holes for the pipes shall not be cut into the structural members, (i.e., top beams and corner columns) and non-shrink grout shall not be allowed to be placed around the pipes. The pipes shall be encased with concrete a minimum of 6 inches around the outside of pipe or a minimum of 3 inches beyond the hole knocked in the wall, whichever is greater. In addition, the concrete encasement shall extend from the inside face of the wall to 1 foot outside the outer face of the wall.

9. Precast structures with knockout panels shall not be used with more than 2 feet of earth cover unless load calculations are supplied.

10. For rectangular structures where pipe will be installed in adjacent walls (other than those with knockout panels), at least 6 inches of wall (measured from the interior corner) is required on each side of the pipe beyond the precast opening for the pipe. This rule is not applicable for structures that have pipe installed in opposite walls or where one outlet pipe is utilized.

7.3.2 Branches and Fittings

All branches and fittings must be inspected to confirm that they are of the proper types and sizes according to Plans. It is extremely important that all branches and fittings are connected properly.

Leakages at branches and fittings may be avoided by ensuring that the bell and rubber gaskets are clean. If gaskets must be placed on the pipe in the field, the direction of the bevel shall be checked.

Bells and gaskets shall be lubricated and connections shall be completed, taking care not to push the pipe too far past the home mark. Excessive insertion of the pipe past the mark may contribute to clogging or cause erroneous deflection readings.

Any branch or fitting which is to remain unconnected for a long period of time during construction shall be temporarily sealed with a cap, plug, or stopper. Backfill shall not be placed over a branch or fitting with an unsealed open end.

If the crushed stone encasements are not properly placed, stresses may develop at branches and fittings and cause cracking. The crushed stone must be placed uniformly around and beneath the branches or fittings to provide adequate support. Workers shall be advised not to stand on a branch or fitting if the stone encasement has not been placed to its final thickness above the pipe.

7.3.3 Stubs

Stubs must be installed as indicated on project Plans. The methods discussed in Section 7.3.2 shall be observed in inspecting the installation of stubs. All stubs must have a minimum length of 1 foot.

7.3.4 Property Service Laterals and Risers

Property service laterals shall be provided to each property adjacent to the collection sewer. Service laterals shall be extended 1 foot outside the easement or 1 foot inside the property line, whichever is greater. The laterals shall have a minimum slope of 1/8-inch per foot length, and a tee section shall be used to connect the lateral service line to the collection line. In general, lateral lines are installed to within 6 feet of final grades. If the collection sewer is deeper than 6 feet, a steeper lateral line is required within the right-of-way or easement so that property connection is less than 6 feet deep outside the easement. If the collection sewer is excessively deep or within a rock excavation, a vertical riser may be required from the sewer connection. A concrete cradle is required to support the vertical riser connection to the sewer collection pipe as shown in the *LFUCG Standard Drawings*.

When inspecting the construction of a riser, the Inspector shall pay particular attention to the dimensions of the riser, the concrete cradle, and the condition of the foundation material supporting the riser. In deep trench cuts on large sewers, it may be necessary to strengthen the riser by using steel reinforcing bars. When such reinforcing is shown on the Plans, the Inspector shall confirm that the proper sizes and grades of steel are used, and that the reinforcing steel is firmly positioned while concrete is placed.

7.3.5 Manholes

As noted earlier, manholes are constructed using precast and/or cast-in-place concrete. All precast units installed in manhole construction shall be inspected to ensure that they are of the types and dimensions as indicated on project Plans. All cast-in-place concrete shall be inspected observing the techniques discussed in Section 11.0.

The installation location and bottom elevation of the manhole are important. The bottom of the manhole excavation shall be checked to confirm that the excavation has been extended to the proper depth, allowing for the thickness of the manhole bottom and the crushed stone bed.

The foundation material shall be checked to confirm that the manhole will bear upon firm soil or rock. If ground or surface water inflow is a problem, the Contractor shall be required to pump the excavation and perform all concrete work in the dry. If high ground water is present, the potential for the manhole to be displaced upwardly because of buoyant forces may exist. This shall be brought to the attention of the Engineer.

An invert channel exhibiting good hydraulic properties is an important objective of manhole construction that frequently is not achieved. The channel shall be, as far as is possible, a smooth continuation of the pipe. According to design procedures, the sewer grades are calculated to the centers of the manholes, and these centers represent points where changes in slope shall occur. In addition, the bench adjacent to the channel shall be sloped downwardly toward the channel.

The concrete surfaces within the riser sections shall be free of voids or honeycombs. The corrosive atmosphere within the manhole makes it very important to determine that sufficient concrete cover is provided over the reinforcing steel. Before each section is placed, the Inspector shall make sure that flexible joint sealant has been placed properly in the groove end of the riser section, or, that a rubber O-ring gasket has been inserted into the recessed slot on the tongue end of the section.

The Inspector shall also verify the alignments and elevations of the openings for the influent and discharge pipes. All pipe openings 15 inches or smaller in diameter shall be provided with positive seal elastomeric gaskets. When inspecting the riser sections, the manhole steps shall be checked to make sure that they are securely embedded in the wall.

The Inspector shall verify that the manhole castings are as specified in the Plans or as shown in the *LFUCG Standard Drawings*. The manhole cover and frame shall have machined seating edges, and the cover shall set neatly in the frame with the top of the cover flush with the top of the frame ring. The covers shall have sufficient corrugations for tire traction and be marked in large letters, "SANITARY" or "STORM SEWER, LEXINGTON, KENTUCKY." The covers shall have two pick holes about 1-1/2 inches wide and 1/2 inch deep with 3/8 inch undercut all around.

All manholes 4 feet or greater in depth shall be equipped with manhole steps spaced as shown in the *LFUCG Standard Drawings* to form a continuous ladder. Manhole steps shall be aligned with the straight side of eccentric cone sections.

All sanitary sewer manholes must pass the application of a vacuum test according to ASTM C1244. During the test, all pipes and lift holes are plugged and a vacuum of 10 inches of mercury shall be drawn on the manhole. The time is recorded for the vacuum to drop to 9 inches of mercury. Minimum allowable test times vary according to manhole depth and diameter and are tabulated in ASTM C 1244; however, LFUCG requires a minimum vacuum test time of one minute (60 seconds), which is contrary to ASTM C1244 for certain manhole depth and diameter combinations. If a manhole fails the initial test, necessary repairs shall be made and the manhole retested until a passing test is obtained. Results of the test shall be documented on the Manhole Vacuum Test Report presented in Chapter 3.

7.3.6 Drop Manholes

Drop manholes are constructed as circular manholes with additional branches and fittings to direct flow from higher invert elevations to the base of the manhole. Accordingly, the inspection techniques discussed in Section 7.3.5 must be followed. During construction of drop manholes, particular attention shall be given to the dimensions of the vertical drop that occurs between the connecting sewer lines. The drop riser, tee, and stub must be encased in concrete as shown in the *LFUCG Standard Drawings*.

7.3.7 Non-Circular Manholes

Non-circular manholes or junction chambers are constructed of precast or cast-in-place concrete. When inspecting the concrete construction of junction chambers, the techniques described in Section 11.0 must be followed. The Inspector shall refer to the Contract Documents for the concrete type specified.

Items of particular concern when constructing junction chambers are the smoothness of the channels contained within the structure, the slope of the chamber floor, and the invert elevations of the adjoining pipes. Turbulence can be a problem in junction chambers, thus the channels constructed in the floor must be as smooth as possible and free of obstructions. The floor of the chamber must be sloped downwardly toward the channels to prevent the accumulation of sewage or sediment in the structure. The invert elevations of the adjoining sewer pipes must conform to those shown on the Plans. Generally, the inverts of branch lines are higher than the invert of the main sewer line to promote smooth flows.

To provide access to the junction chamber, an opening is provided in the top of the structure. Generally, the opening is constructed with standard precast manhole sections and the same manhole castings described in Section 7.3.5 are used and securely fastened. If required, vacuum testing shall be performed as described in Section 7.3.5.

7.3.8 Storm Sewer Inlets

The majority of storm sewer inlets are constructed using precast concrete. Similar to other appurtenances, storm sewer inlets must be constructed to the required sizes and dimensions as indicated on project Plans. An area of particular concern when constructing a storm sewer inlet is the location and diameter of the opening for the outgoing sewer pipe. All pipe connections shall be grouted and watertight. In addition, all castings used in association with the storm sewer inlet must be securely fastened. Only approved castings are permitted.

7.3.9 Headwalls

Headwalls may be of precast or cast-in-place construction. The techniques discussed in Section 11.0 shall be undertaken when inspecting cast-in-place headwalls. Following construction of the headwall, backfill must be carefully placed around the sewer pipe and the headwall to avoid cracking of the concrete.

7.4 References

7.4.1 Publications

Construction Inspection Guidance Manual, Louisville and Jefferson County Metropolitan Sewer District (MSD), Revised Edition, May 1993.

Lexington Fayette Urban County Government Standard Drawings, June 1997, Review Submittal.

7.4.2 Test Methods and Specifications

ASTM C 478, *Specification for Precast Reinforced Concrete Manhole Sections.*

ASTM C 1244*, Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test*.

7.5 Appurtenances Inspection Checklist

7.5.1 General

	Yes	No	N/A	
(1)	____	____	_____	Are all appurtenance structures constructed to the proper dimensions and locations in accordance with the Plans?
(2)	____	____	_____	Are the foundations for all appurtenances properly prepared?
(3)	____	____	_____	If an appurtenance structure is to be constructed upon soil, is the soil subgrade adequate to support the structure?
(4)	____	____	_____	If the appurtenance is to be constructed on rock, is a cushion of crushed stone provided between concrete faces and the rock?
(5)	____	____	_____	Are any branches, fittings, stubs, or sewer pipes that are to remain unconnected following completion of the project properly sealed?
(6)	____	____	_____	Do precast structures meet the appropriate criteria?
(7)	____	____	_____	Have the precast structures been approved for use by the LFUCG Division of Engineering?
(8)	____	____	_____	Are pipe openings of proper size and location?
(9)	____	____	_____	Have shop drawings been submitted and approved?

7.5.2 Branches and Fittings

	Yes	No	N/A	
(1)	____	____	_____	Are all branches and fittings properly connected?
(2)	____	____	_____	Are spigot ends and gaskets being lubricated?
(3)	____	____	_____	Are connections being made so that no twisting or folding of the rubber gasket used to seal the connection occurs?
(4)	____	____	_____	Is proper care being exercised by the Contractor to ensure that the property service connection sewer is not pushed too far into the branch?

	Yes	No	N/A	
(5)	____	____	____	Prior to being covered with crushed stone, are branches or fittings that have been installed in the collector sewer, but which have not yet been connected to a property service connection, been temporarily sealed with a stopper?
(6)	____	____	____	Is crushed stone properly placed around and beneath all branches and fittings to prevent cracking at the fitting?
(7)	____	____	____	Are caps or plugs being placed at the upstream end of property service connections?

7.5.3 Stubs

	Yes	No	N/A	
(1)	____	____	____	Are stubs installed according to Plans?
(2)	____	____	____	Are the stubs properly sealed?
(3)	____	____	____	Are stubs a minimum of 1 foot in length?

7.5.4 Property Service Laterals and Risers

	Yes	No	N/A	
(1)	____	____	____	Has a service lateral been installed to each property?
(2)	____	____	____	All risers provided where needed?
(3)	____	____	____	When installed, are risers constructed to the proper elevations above the collector sewer?
(4)	____	____	____	Are the risers cradled in concrete in accordance with the *LFUCG Standard Drawings* or Contract Documents, as appropriate?
(5)	____	____	____	Are the riser slopes in accordance with the *LFUCG Standard Drawings* or Contract Documents, as appropriate?

7.5.5 Manholes

	Yes	No	N/A	
(1)	____	____	____	Are the openings constructed in the base section of the sewer pipes of the appropriate sizes and at the proper elevations?
(2)	____	____	____	If required by the Contract Documents, are the openings fitted with positive seal elastometric gaskets?
(3)	____	____	____	Are manholes constructed so that they are watertight and are the proper seals or O-ring gaskets used in all joints?
(4)	____	____	____	Is the channel in the base section constructed using the correct grades, diameters, and invert elevations?
(5)	____	____	____	Is the bench sloped downwardly toward the channel?
(6)	____	____	____	Do all castings conform to the *LFUCG Standard Drawings* or Contract Drawings, as appropriate?
(7)	____	____	____	Are the casings properly placed and securely fastened?
(8)	____	____	____	Have all sanitary sewer manholes passed a vacuum test?
(9)	____	____	____	Have the test results been documented on the Manhole Vacuum Test Report?

7.5.6 Drop Manholes

	Yes	No	N/A	
(1)	____	____	____	Does the extend of the vertical drop provided correspond to the Plans?
(2)	____	____	____	Is the drop inlet properly constructed with tightly sealed fittings that are firmly connected to the manhole before the concrete encasement is placed?
(3)	____	____	____	Is the drop inlet properly encased in concrete as shown in the *LFUCG Standard Drawings* or Contract Drawings, as appropriate?

7.5.7 Non-Circular Manholes and Junction Chambers

	Yes	No	N/A	
(1)	____	____	_____	Are the cast-in-place concrete junction chambers constructed according to the techniques discussed in Section 11.0?
(2)	____	____	_____	Are the channels in the junction chamber smooth and constructed on a uniform grade(s) through the chamber?
(3)	____	____	_____	Is the bench sloped downwardly toward the channels?
(4)	____	____	_____	Do the invert elevations of adjoining sewer pipes conform to the Plans?
(5)	____	____	_____	Is the access opening of the junction chamber properly constructed?
(6)	____	____	_____	Are all castings installed for the opening securely fastened?
(7)	____	____	_____	Do the castings conform to the *LFUCG Standard Drawings?*

7.5.8 Storm Sewer Inlets

	Yes	No	N/A	
(1)	____	____	_____	Are all connections between the inlet box and storm sewers grouted and watertight?
(2)	____	____	_____	Are all castings used in association with the storm sewer inlet securely fastened?
(3)	____	____	_____	Do the castings conform to the *LFUCG Standard Drawings*, where appropriate?
(4)	____	____	_____	Were the proper types of grates and curb boxes provided?
(5)	____	____	_____	Is the outlet pipe placed at the proper elevation and is it of the proper diameter?

7.5.9 Headwalls

	Yes	No	N/A	
(1)	____	____	____	Are cast-in-place concrete headwalls constructed using the techniques discussed in Section 11.0?
(2)	____	____	____	Is backfill carefully placed around the sewer pipe and headwalls in such a manner that no cracking of the concrete occurs?

Appendix

Blank Construction Reporting Forms

DAILY FIELD REPORT

Page __ of __

Project ______________________________ Date ______________________________

Location ______________________________ Inspector ______________________________

Project/Contract No.______________________________ Contractor ______________________________

Weather ______________ Temperature __________ Present at Site______________________________

THE FOLLOWING WAS NOTED TODAY:

____

____

____

____

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____

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____

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____

____

____

____

Copies To: ______________________________ Signed:

______________________________ ______________________________

Attachments: ______________________________

____

FIELD DENSITY REPORT

Project ______________________ Contractor ______________________

Project/Contact No. ____________ Date ______________ Inspector ______________

Test No.	Test Location	Dry Density (pcf)	Moisture (%)	Proctor Density (pcf)	Optimum Moisture (%)	Compaction (%)	Required Compaction (%)	Pass or Fail

Remarks: ____

LOW-PRESSURE AIR TEST REPORT

Project ______________________________ Date ______________________________

Location ______________________________ Inspector ______________________________

Project/Contract No. ______________________________ Contractor ______________________________

Pipe Under Test				Specification Time	Field Test Operations Data						Deflection Test
Upstream MH sta #	Downstream MH sta #	Dia D (in)	Length L (ft)	Refer to UNI-B-6, ASTM F1417 (min:sec)	Pressure Initially Raised To (psig)	Time Allowed for Pressure to Stabilize (min)	Start Test Pressure (psig)	Stop Test Pressure (psig)	Elapsed Time (min:sec)	Pass or Fail (P or F)	Pass or Fail (P or F)

If a section fails, the following items should be completed:

Identify section(s) that failed ______________________________ Description of leakage found: ______________________________

Leak (was) (was not) located. Method used: ______________________________ Description of corrective action taken: ______________________________

Remarks: ______________________________

INFILTRATION/EXFILTRATION TEST REPORT

Project ______________________	Date ______________________
Location ______________________	Inspector ______________________
Project/Contract No.______________________	Contractor ______________________

☐ Infiltration Test ☐ Exfiltration Test

(1) TEST INFORMATION:

Pipe Description ______________________________________

Pipe Diameter (A) ______________________(inches)

Pipe Length (B) ______________________(feet)

Length of Test (C) ______________________(hours)

(2) ALLOWABLE LEAKAGE:

Total Allowable Leakage (TAL) = 200 gallons per inch diameter, per mile of pipe, per 24 hours.

TAL $= 200 \times A \times (B \div 5{,}280) \times (C \div 24)$

= 200 x _________ x (________ ÷ 5,280) x (_________ ÷ 24)

= _________ gallons

(3) TEST RESULTS:

The Total Leakage for Test (TLT) for the exfiltration test may be determined by measuring the decrease in the height of the water in the manhole. If this method is utilized, the following formula may be used to calculate the TLT in terms of gallons:

Diameter of Manhole (D) __________________(feet)

Decrease in Manhole Water Level (E) __________________(feet)

TLT $= E \times 3.14 \times (D \div 2)^2 \times 7.48$

= ________ x 3.14 x (________ ÷ 2)^2 x 7.48

= ________(gallons)

Final Result ____________________________

MANHOLE VACUUM TEST REPORT

Project________________________________ Date________________________________

Location________________________________ Inspector________________________________

Project/Contract No. ____________________ Contractor________________________________

(1) MANHOLE INFORMATION:

Manhole Station ________________

Manhole Diameter ________________ (feet)

Manhole Depth ________________ (feet)

Minimum Test Time________________ (sec) (See Table)

(2) TEST RESULTS:

Test Starting Time ____________ Gauge Reading ____________(in. Hg)

Test Ending Time ____________ Gauge Reading ____________(in. Hg)

Final Result ________________

Minimum Test Times for Various Manhole Diameters (seconds)

~NOTE: If the test time is grayed out in the table below, then the vacuum test time for that particular manhole diameter and depth shall be a minimum of one minute.~

Manhole Depth (ft)	Manhole Diameter (ft) 4.0	4.5	5.0	5.5	6.0
	Time (seconds)				
8	20	23	26	29	33
10	25	29	33	36	41
12	30	35	39	43	49
14	35	41	46	51	57
16	40	46	52	58	67
18	45	52	59	65	73
20	50	53	65	72	81
22	55	64	72	79	89
24	59	64	78	87	97
26	64	75	85	94	105
28	69	81	91	101	113
30	74	87	98	108	121

PUMP STATION WET WELL VACUUM TEST REPORT

Project____________________________________ Date____________________________________

Location___________________________________ Inspector________________________________

Project/Contract No.________________________ Contractor _____________________________

(1) WET WELL INFORMATION:

Wet Well Diameter ________________(feet)

Wet Well Depth ________________(feet)

Minimum Test Time ________________(minutes)

(2) TEST RESULTS:

Test Starting Time ________________ Gauge Reading______________(in. Hg)

Test Ending Time ________________ Gauge Reading ___________(in. Hg)

Final Result ________________

Minimum Test Times for Various Wet Well Diameters (minutes)

Wet Well Depth (ft)	**Wet Well Diameter (feet)** 4.0	5.0	6.0	8.0
	Time (minutes)			
<20	1	2	3	4
>20	2	3	4	5

PUMP STATION EQUIPMENT CHECK LIST

Project____________________ Date____________________

Location____________________ Inspector____________________

Project/Contract No.____________________ Contractor____________________

☐ Review Specifications ☐ Copies of O & M Manual

Access Road: ☐ Paved ☐ Stone

Landscape: ☐ Stone ☐ Sod ☐ Seed

Valve Pit

Vent: ☐ Paint ☐ Hatch Hole Open Arm & Spring ☐ Clean

☐ Drain Check Value ☐ Air Relief Valve ☐ 3 Gauge Taps

Gauge: ☐ Ft. of H_2O (head) ☐ Pressure

☐ Check Value (spring) ☐ Gate Valve Rising Stem (handwheel)

Pump Station

Vent: ☐ Paint ☐ Hatch Hole Open Arm & Spring ☐ Leafs

☐ Pump Cable Holder S.S. ☐ Tilt Bulb Holder S.S.

☐ Pump Lifting Cable S.S. ☐ Pump Rails S.S.

☐ Pipe ☐ Bolts S.S. ☐ Rail Supports S.S. ☐ Anchor Bolts S.S.

Electric

Service Pole: ☐ Main Disconnect ☐ Single Phase ☐ Three Phase

☐ Light ☐ Telemetry Panel

☐ Rigid Conduit

Control Cabinet

☐ Stand S.S. ☐ Cabinet S.S. ☐ Vault Door Closure Handle

☐ Telemetering S.S. ☐ Transformer Outdoor Use

Check

- ☐ Plumb Alignment of Guide Rails
- ☐ Easy Pump Removal Through Access Hatch

Tilt Bulb Elevations: ☐ Pump Off ☐ No. 1 Pump On
☐ No. 2 Pump On ☐ High Wet Well Level

- ☐ Tilt Bulb Cable Holder Location for Operational Clearance

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- ☐ Power Cable Loop Length (2 ft min)
- ☐ Rigid Conduit
- ☐ Seal Cable into Cabinet
- ☐ Review Plan and Control Cabinet Instruments for Compliance

Remarks ____

PUMP STATION START-UP REPORT

Project ______________________________ Date ______________________________

Location ______________________________ Inspector ______________________________

Project/Contract No. ______________________________ Contractor ______________________________

Pump Specifications:

Manufacturer ______________________________ Model No. ______________ H.P. _______

Phase ___________ Cycle __________ Volts _______ Amps ______________ GPM _______

Number 1 Pump Serial Number ______________________________

Design Total Head ______________________________ Operating Head ______________________________

Number 2 Pump Serial Number ______________________________

Design Total Head ______________________________ Operating Head ______________________________

Design Total Head Both Pumps ______________________ Operating Head ______________________

Telephone Service Number ______________ Electric Meter Number ______________________________

Incoming Voltage P-1 __________ P-2 ___________ P-3 __________

Manual Operating Pump Number 1: Running Light On _____________

Amps: P-1 _______ P-2 _______ P-3 _______ Volts: P-1 _______ P-2 ______ P-3 ______

Gauge Reading PSI ______________ x 2.304 = ______________ Ft. of H_2O Head

Piping Leaks ____________________ Check Valve Operation ________________

Manual Operating Pump Number 2: Running Light On _____________

Amps: P-1 _______ P-2 _______ P-3 _______ Volts: P-1 _______ P-2 ______ P-3 ______

Gauge Reading PSI ______________ x 2.304 = ______________ Ft. of H_2O Head

Piping Leaks ____________________ Check Valve Operation ________________

Manual Operation Both Pumps:

Pump Number 1

Amps: P-1 _______ P-2 _______ P-3 _______ Volts: P-1 _______ P-2 ______ P-3 ______

Pump Number 2

Amps: P-1 _______ P-2 _______ P-3 _______ Volts: P-1 _______ P-2 ______ P-3 ______

Discharge Gauge Reading: PSI _________ x 2,304 = _________ Ft. of H2O Head

PUMP STATION START-UP REPORT (continued)

Automatic Operation:

Lead Selector Pump No. 1

Pump On ________________ Pump Off ________________

Lead Selector Pump No. 2

Pump On ________________ Pump Off ________________

Remarks:____

____

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Inspector ____________________________ Contractor ____

Factory Service Representative _

FORCE MAIN HYDROSTATIC TEST REPORT

Project___________________________________ Date____________________________________

Location__________________________________ Inspector________________________________

Project/Contract No.______________________ Contractor_______________________________

(1) TEST INFORMATION:

Pipe Description/Location____

Pipe Diameter (A) ____________ (inches)

Pipe Length (B) ____________ (feet)

Length of Test (C) ____________ (hours)

Testing Pressure ____________ (psi)

Note: Testing pressure equals 100 psi or twice the surge plus operation pressure, whichever is greater, but not to exceed 125 percent of the maximum pressure rating for the pipe, measured at the downstream end.

(2) ALLOWABLE LEAKAGE:

Total Allowable Leakage (TAL) = 0.5 gallons per inch diameter, per 1,000 feet, per hour.

TAL = 0.5 x A x (B ÷ 1,000) x C = 0.5 x ________ x ________ ÷ 1,000 x _________

= ________ gallons

(3) TEST RESULTS:

Test Starting Time ____________ Meter Reading (D) _________ (gallons)

Test Ending Time _____________ Meter Reading (E) _________ (gallons)

Total Leakage for Test (TLT) = E - D = _________ - _________ = _________ gallons

Final Result ________________________

PAVEMENT SUBGRADE INSPECTION REPORT FORM

Project ______________________________ Date ______________________________

Street Name ______________________________ Inspector ______________________________

Station ________ to ________ Contractor ______________________________

Project/Contract No.______________________________

Weather__________ Temperature______________

General:

	YES	NO	N/A	Remarks
Bedrock Undercut Performed	☐	☐	☐	
Utilities Installed	☐	☐	☐	
Ruts	☐	☐	☐	
Alignment/Grade Correct	☐	☐	☐	
Large Stones	☐	☐	☐	
Excessive Dust	☐	☐	☐	
Wet	☐	☐	☐	
Field Density Tests	☐	☐	☐	

Subgrade Stabilization:

Stabilization Method:

- ☐ Not Required
- ☐ Material Removal and Replacement
- ☐ Crushed Stone
- ☐ Geosynthetics
- ☐ Chemical (Lime or Cement)

Remarks ______________________________

____

____

Proof Roll:

Truck Model ____________________

Gross Weight ____________________

☐ Pass ☐ Fail

Remarks ____________________

____

____

____

PRE-CONCRETING INSPECTION REPORT

Project ______________________ Date ______________________

Location ______________________ Inspector ______________________

Project/Contract No. ______________________ Contractor ______________________

Structure/Element ____

Plans Used

☐ Contract Drawings ☐ Shop Drawings Drawing No.(s) ______________________

Do the following items comply with **Plans and Contract Documents?**

REINFORCING STEEL

	YES	NO
Rebar Size	☐	☐
Spacing	☐	☐
Supports	☐	☐
Straight	☐	☐
Clean	☐	☐
Tied	☐	☐
Clearances	☐	☐
Dowels	☐	☐
Damaged Epoxy Repaired	☐	☐

FORMS

	YES	NO
Size/Alignment	☐	☐
Clean	☐	☐
Wet or Oiled	☐	☐
Tightness	☐	☐

EXCAVATION

	YES	NO
Level	☐	☐
Loose Soil Remove	☐	☐
Free of Water	☐	☐

REMARKS ____

____

____

____

____

____

REPORT OF TEST ON CONCRETE CYLINDERS

Project ______________________________ Date ______________________________

Location ______________________________ Inspector ______________________________

Project/Contract No.______________________________ Contractor ______________________________

(1) FIELD DATA:

Location of Concrete ______________________________

Cylinder/Set No. ____________ Slump____________(inches) Air Content ______(%)

Concrete Temperature ____________(°F) Ambient Temperature ____________(°F)

Specified Strength & Type ____________ Date Sampled ____________

(2) LABORATORY RESULTS:

Cylinder Number						
Date Received						
Date Tested						
Age When Tested (days)						
Maximum Load (pounds)						
Compressive Strength (psi)						

(3) REMARKS:

____

____

CONTRACTOR SUBMITTAL LOG

Project ______________________________ Submittal Log Issue Date ______________________

Project/Contract No. ______________________ Contractor ______________________

Date Rec'd	Trans. mittal No.	Description	Ref. Spec. Section	Con tractor Trans. No.	No. Copies Rec'd	Action				Date Returned	Copies No Copies Ret'd	Remarks
						No Exceptions Taken	Made Noted Corrections	Revise & Resubmit	Rejected			

EROSION AND SEDIMENT CONTROL INSPECTION AND MAINTENANCE REPORT FORM

(to be completed every 7 days and within 24 hours of a rainfall event of 0.5 inches or more)

Project ______________________ Date ______________________

Project/Contract No. ______________________ Contractor ______________________

Location ______________________ Inspector ______________________

Days since last rainfall ______________________ Amount of last rainfall ______________ inches

STABILIZATION MEASURE SUMMARY

Area	Stabilization Type	Stabilization Installed Correctly?	Date of Stabilization	Condition of Stabilization	Maintenance Needed?	Date of Repairs	Date of Final Stabilization	Remarks